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Department Code 300.1

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Department 7809

Subject Radiation Report on 54AC245
SMEX Common Buy Part No. 5962-8775801RA

Interoffice Memorandum

PPM-91-442

Date

July 01, 1991

Location També

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A radiation evaluation was performed on 54AC245 to determine the total dose tolerance of these parts. A brief summary of the test results is provided below. For detailed information, refer to Tables I through IV and Figure 1.

The total dose testing was performed using a cobalt-60 gamma ray source. During the radiation testing, eight parts were irradiated under bias (see Figure 1 for bias configuration), and two parts were used as control samples. The total dose radiation steps were 10, 20, 30, 50, 75, and 100 krads. After 100 krads, parts were annealed at 25°C for 24 and 168 hours, and then the irradiation was continued to 200 and 300 krads (cumulative). The dose rate was between 0.5 - 5.5 krads/hour, depending on the total dose level (see Table II for radiation schedule). After each radiation exposure and annealing treatment, parts were electrically tested according to the test conditions and the specification limits listed in Table III. These tests included two functional tests (1 MHz) at 3.0 V and 5.5 V

All parts passed all initial tests, and stayed within the specification limits for all parameters on irradiation up to 30 krads. Some parametric failures were observed for  $I_{\rm CCL}$ ,  $I_{\rm CCH}$  and  $I_{\rm CCZ}$  after radiation exposures to 50, 75, and 100 krads. After 100 krads, the readings for these parameters ( $I_{\rm CCL}$ ,  $I_{\rm CCH}$  and  $I_{\rm CCZ}$ ) ranged from 0 to 376 uA, 0 to 1.26 mA, and 0 to 516 uA, respectively against a maximum specification limit of 160 uA for all three parameters. However, all parts passed both functional tests (at 3.0 and 5.5V) on irradiation up to 100 krads.

On annealing for 24 and 168 hours, parts showed some recovery in  $T_{\rm CCL}$ ,  $T_{\rm CCH}$ , and  $T_{\rm CCZ}$ , but overall, most parts continued to exceed the specification limits for these parameters. On continued irradiation to 200 krads, parts exceeded the specification limits

on a number of parameters including I<sub>IHZ</sub>, I<sub>OZH</sub>, I<sub>IL</sub>, I<sub>OZI</sub>, VOL2, and VOL3. However, all parts passed both functional tests. However, after 300 krads 7 parts failed functionally as well. Table IV provides the mean and standard deviation values for each parameter after different radiation exposures and annealing treatments. It also provides a summary of functional test results after each radiation/annealing step.

Any further details about this evaluation can be obtained upon request. If you have any questions, please call me at (301) 731-8954.

## TABLE I. Part Information

Generic Part Number:

54AC245

SMEX Common Buy Part Number:

5962-8775801RA (HA124239)

SMEX Common Buy Control Number:

1658

Charge Number:

C90099

Manufacturer:

National Semiconductor Corp.

Quantity Procured:

197

Lot Date Codes:

9036A

Quantity Tested:

10

Serial Numbers of Radiation Samples:

402, 403, 404, 405, 406, 407, 408, 409

Serial Numbers of Control Samples:

400, 401

Part Function:

Octal Bidirectional Transceiver

Part Technology:

CMQS

Package Style:

20 Pin DIP

TABLE II. Radiation Schedule

EVENTS	DATE
1) Initial Electrical Measurements	05/01/91
2) 10 krads irradiation @ 555 rads/hr	05/16/91
Post 10 krads Electrical Measurements	05/1 <b>7</b> /91
3) 20 krads irradiation @ 555 rads/hr	05/17/91
Post 20 krads Electrical Measurements	05/18/91
4) 30 krads irradiation @ 500 rads/hr	05/18/91
Post 30 krads Electrical Measurements	05/19/91
5) 50 krads irradiation @ 1050 rads/hr	05/19/91
Post 50 krads Electrical Measurements	05/20/91
6) 75 krads irradiation @ 1350 rads/hr	05/20/91
Post 75 krads Electrical Measurements	05/21/91
7) 100 krads irradiation @ 1350 rads/hr	05/21/91
Post 100 krads Electrical Measurements	05/22/91
8) 24 hour annealing	05/22/91
Post 24 hr Electrical Measurements	05/23/91
9) 168 hour annealing	05/22/91
Post 168 hr Electrical Measurements	05/29/91
10) 200 krads irradiation @ 5550 rads/hr	05/29/91
Post 200 krads Electrical Measurements	05/30/91
11) 300 krads irradiation @ 5550 rads/hr	05/30/91
Post 300 krads Electrical Measurements	05/31/91

### Notes:

- 1) All parts were radiated under bias at the cobalt-60 gamma ray facility at GSFC.
- 2) All electrical measurements were performed off-site at 25°C.
- 3) Annealing performed at 25°C under bias.

Table III. Electrical Characteristics of 54AC245

- 1			·	· · ·		
ŀ	PARAMETER	V C C	VIL VIH	CONDITIONS	PINS	LIMITE IS ABEA
ŀ	FUNCT #1	3.07	0.0V 3.0V		====	LIMITS H +25C
ŀ	FUNCT #2	5.5V	0.0V 3.0V 0.0V 5.5V	FREQ = 1MHZ FREQ = 1MHZ		YULK1.50V . VAHS4 5AV
1				FREQ = 1MHZ	ALL I/O	VOC<2.75V / VOH52.75V
1	PARAMETER	VCC_	VIL VIH	CONDITIONS	PINS	
Ŀ	V0H1	3.UV	0.90V 2.10V	~~~~~~~~~	====	LIMITS & +25C
ŀ	Võiis	4.50	0.90V 2.10V 1.35V 3.15V			22.90V / <5.50v
1	VOH3	5.5V	1.650 3.350	LOAD = -500A		24.40V / <5.50v
ŧ	Y DH 4	3.UV	- U_9NV 2_1NV	LOAD = -4MA	0012 0012	25.40V / <5.50v
ſ	4 0 4 2 7 0 H 2	4 - 5 V	1.35V 3.15V 1.65V 3.85V 1.65V 3.85V	LOAD = -24MA	2 7 11 0	>3-40V / <5-50V
1	v ö#7	5.5V 5.3V	1-650 1-950	LDAD = $-24MA$	OUTS	>3.70V
		J.J.	1-054 3-574	LOAD = -SOMA	DŪŤŠ	>3.85v . <5.50v
1	PARAMETER	VCC	VIL VIH	CONDITIONS	DTUE	
ı	#= # # # # # # # # # # # # # # # # # #	****	##==# ==# <b>=</b>		PIMS	LIMITS B +25C
Į	V@L1 V@L2	3. yy	9.900 2.100	LOAD = +50UA	DUTS	>0.00V / <0.10V
	võt ŝ	4 • 5 V 5 • 5 V	1.350 3.150	LOAD = tSQUA	OUTS	>0.00v / <0.10v
f	võl 4	3.0V	1.65V 3.85V U.90V 2.10V	LOAD = +5004 $LOAD = +12MA$	OUTS	<b>♪∪.∪∪∀ ╭ &lt;∂.1∩∨</b>
l	V D L S	4.5V	1.35V 3.15V	LQAD = TIZMA	onîz	>0.00V / <0.50v
ı	V C L 6	5.5V	1.65V 3.85V	10AD = +24MA	OUTS	>U-QOV / <0.50v
ļ	VOL7	5.57	1-054 3.054	LOAD = +50MA	ÖÜTS	>0.00V / <0.50V >0.00V / <1.65V
	RAMETER	VCC	VIL VIH	COMMETTERNS		>0.00V / <1.65V
lı.	그 프로 감색 등 교 현	====	===== ================================	CONDITIONS	PINS ====	LIMITS & +25C
	}	5.5V	0.00V 5.50V	VIN = 5.5V	DE_/DIR	
	11d2 11L	5.5V	0.000 5.500	VIN = 5.5V	OTRÉR ÎNPUTS	> 0.0UA
	TÓŹH	5-5V	y.00v 5.50v	VIN ≈ 0.0V	INS	> 0.00A / <+1.00A > -1.00A / < 0.00A
1	inii	3.5V 5.5V	0.00V 5.50V	VůÚT = 5.5V VůUT = 0.6V	σμ <u>τ</u> s	> 0.0HA 2 2+16.6Ha
Ħ	ICCH	5.5v	0.00V 5.50V	VOUT = 0.0V	OUIS	> -10.0UA / < 0.0UA /
$\ $	ICCL	5.50	0.000 5.500	VIN = 5.5V	YCC YCC	> 0.00A / <160.00A
11	ĪČŪŽ	5.ŠV	U.UOV 5.39V	VÎN = 5.5V	νčč	
				·		> 0.0UA > <180.00A

# COMMENTS/EXCEPTIONS

<sup>(1)</sup> FUNCTIONAL TEST #1 WAS PERFURMED WITH IOH= -4.0MA AND IOL=12MA

<sup>(2)</sup> FUNCTIONAL TEST #2 WAS PERFORMED WITH IOH= -24.0MA AND IOL=24MA

<sup>(3)</sup> VIL  $\aleph$  VIH ( FOR THE BIDIRECTIONAL PINS ) WERE TESTED DURING THE VOL \$ VOH TESTS AS GOVNO GO

<sup>(4)</sup> GE\_ AND DIR INPUTS HERE KEPT AT OV AND VCC DURING THE VOH TESTS.

<sup>(5)</sup> NU AC PARAMETERS WERE TESTED.

TABLE IV: Summary of Electrica asurements after Total Dose Exposures and Annealing for 54AC245

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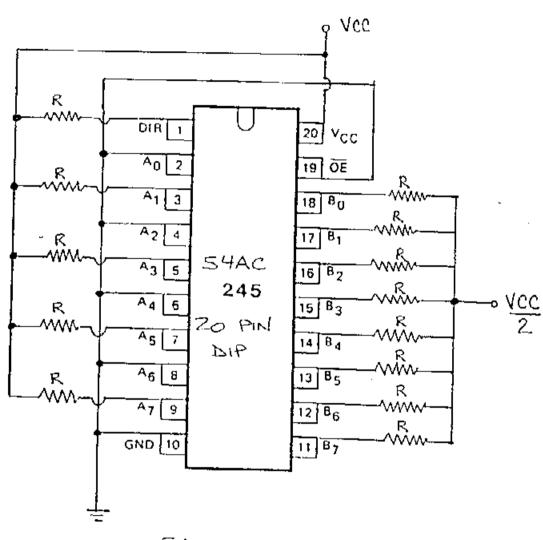
																					Total Dose				
								Tot	<u>al_</u>	Dose	Ex	posur	e (	krad	s)	<del></del>		7	Annealing			Exposure (krads)			
		ı. Di	pec. imits	Init		10	)	20		30		50		75		100		24 hrs		168 hrs		200		300	
Parameter		mi:	n max	mean	sd	mean		mean	sd	mean	sd	mean	sd	mean	sc.	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
Test	#1			8P/OF		EP/OF		8P/0F	L	BP/GF		8P703		50/0F		8P/OF	8	8P/5P		8P/CF		8P/CF		8P/OF	T
Test	#2	ļ		2570£	}	8P/0F		8P70F	L_	BP/OF		81/03		SP/OF		8270F		8P/CT		82/OF		BP/CT		82/02	
VOH1	♡	2.9	5.5	3,5	.003	3.0	.003	3.0	.003	3.0	.003	3.0	.003	.2.0	.003	3.0	.004	3.0	1	3.0	.003	145.815.000	002	3.0	<del></del>
VOH2	V	4.4	5.5	4.5	.004	4.5	.003	4.5	.003	4.5	2.8	4.5	.002	4.5	.003	-apres (3:37.3	.003	16323333	. 003			4.5			<del> </del>
VOH3	v	5.4	5.5	5.49	.002	5.43	.001	5,49	.002	5.49	.001	12:23:23:4:4:4	<del>                                     </del>	5,49	.002	(8.20.30.00.00	.002	5300000000	1	5.29	.001	7::073::.	<del>"</del>	4.5	.003
VCH4	v	2.4	5.5	2.9	.005	2.9	.003	2.9		2.9	.004			2.92	<del> </del>	200000	: -	2.9	!		<del>                                     </del>	5,49	.002	98 2 88 8 8 8	.002
VOH5	7/	3.7	5.5	4.2	,61	4.2	.012		.013		.020	***********	.013	9.500000	.015		<del>;</del>	4.1	.012	2.9 4.1	.006		.004	2,9	.006
VOH6	v	4.7	5.5	5,2	.009	5.2	.012		.012	5.2	.021	300000000000000000000000000000000000000	.011	5.2	.014		.018		.010	5,2	.031	9.1 5.2	.013	4.1	.014
VOH7	v.	3.55	5.5	4.9	.018	4.9	.026	4,9	. 025	4.8	.039		.025			4.8	.038	51. V (10.00 /c)	.020	4.8	.076	4.8	.022	5.2 4.8	.01:
VOL1	m∇	0.0	100	C.5		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0	.022	3.4	.026 26
VOL2	mV	0.0	100	o.c		0.0		0,0	j:	0.0	<b>-</b>	0.0		0.0		0.0		0.0	<b>-</b>		.8	110	295	77 and 12 and 12	428
VOL3	mΨ	0.0	100	.2	1	3.3	1.2	.5	1.5	5	1.5	5	1.5	. 2	.9	. 4	1.3	.3	1,1	1.2	2.4	510	522	3.3	512
VCL4	mV	0.0	500	:142	4	144	6	145	7	145	7. j	142	6	14;	5	141	7	140	<del></del>	147	9	152	53		107
VOL5	mV.	0.0	500	206	7	212	11	214	13	214	15	210	11	208	8	210	12	207	8	221	1ê (	210	9	:: ::v	160
VOL6		0.0	500	182	7	188	11		13	190	14	1 <b>8</b> 6	11	183	8	186	12	183	8	198	18	197	9		10
VOL7			1650		15	401	25	405	27	406	31	397	22	292	16	397	26	392	16	421	37	398	18	2 2 2 2 2 2	20
IIH1 IIH2			1000	.C.O	3 4.1	0.C	a.ı	0.0   1.3	2.8	0.0		0.0		(C.)	<b>-</b>	0.0		0.0		0.0		0.0		0.0	
IIL		1000			i	0.0				9.4	19	7.0	32	1.0 0.0	42	20 0.c	75	.3	·	10	60	3	11		53
ICZH	nA	0.0	0000	. <b>. 4</b>	4.1	8				2 - 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2 -	19			10	41	20	75	0,0 12	15.	0.0	60	2,6	5.4		4e5
ICZL		10.0			[::			0.0 -				0.0		0.0		0.0		CVO						16 -3734 4	53
ICCL		0.0	160			***	[			5.4	13	21	57 🛴		163		108	37	B4 8	28	66		918		676
ICCZ	μA  μΑ	0.0	160	0.0 -	<u>  ;</u>   :	0.0	( <u>)</u>	0.0 - 0.0 -		0.0	4 . 1	33 27		·····					<del></del>		<del></del>		2169	3207 3	
	- Practi			·. <u>₹₹₹.</u>		,~**.i		* F. W. C. C.	<u>.: [:</u>	SAMILE .		89 <b>4</b> (885)	ec 🎮	127	251	125	171 <u>[</u>	82	15C	64.	123 🗒	1400	1900	2809 2	.937

#### Note:

<sup>1/</sup> The mean and standard deviation values were calculated over the eight parts irradiated in this testing. The control samples remained constant throughout the testing and are not included in this table.

Figure 1. Radiation Bias Circuit for 54AC245

t - 17-



54AC245 20 PIN DIP

$$V_{cc} = 5.0 \text{V} \pm 10\%$$
 $R = 1.0 \text{K} \Omega, 5\%, 1/4 \text{W}$ 
 $\frac{V_{cc}}{2} = 2.5 \text{V} \pm 10\%$ 
 $T_{A} = 25\%$